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SDGs and Engineering Mapping

By

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Sustainable Development

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What are SDGs?

RIO+20
United Nations Conference on Sustainable Development

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Sustainable Development Goals

- SDG1: End Poverty.
- SDG2: Zero Hunger
- SDG3: Good Health and Well- being
- SDG4: Quality Education
- SDG5: Gender Equality
- SDG6: Clean Water and Sanitation
- SDG7: Affordable and Clean Energy
- SDG8: Decent Work and Economic Growth
- SDG9: Industry, Innovation and Infrastructure
- SDG10: Reduced Inequalities
- SDG11: Sustainable Cities and Communities
- SDG12: Responsible Consumption and Production
- SDG13: Climate Action
- SDG14: Life Below Water
- SDG15: Life on Land
- SDG16: Peace Justice and Strong Institutions
- SDG 17: Partnerships for the Goals

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Grand Challenge

A specific barrier that, if removed, would help to solve an important world-wide problem.

If successfully implemented, the solution would have a high likelihood of feasibility for scaling up and world –wide impact.

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Ranking of challenges

- Ability to reduce burden on humanity
- Impact on equity
- Immediacy of impact
- Feasibility

All the challenges emphasize:

- Need for global cooperation
- Creation of shared access to data,
- Expertise and capacity-building opportunities.

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14 Engineering Grand Challenges

Make Solar Energy Economical

Engineer the Tools of Scientific Discovery

Provide Energy From Fusion

Develop Carbon Sequestration Methods

Manage the Nitrogen Cycle

Provide Access to Clean Water

Improve Urban Infrastructure

Advance Health Informatics

Source: http://www.ni.com/company/corporate-responsibility/empower/improve/grand-challenges.htm

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14 Engineering Grand Challenges

Engineer Better Medicines

Reverse-Engineer the Brain

Prevent Nuclear Terror

Secure Cyberspace

Enhance Virtual Reality

Advance Personalized Learning

Source: http://www.ni.com/company/corporate-responsibility/empower/improve/grand-challenges.htm

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– 9 Global Challenges

⇑ Urbanisation

⇑ Population

Alleviating poverty

⇑ Energy demand

Climate Change

⇑ Water demand

⇑ Food demand

Biodiversity

Infectious diseases

Source : Sir John Beddington UK Chief Scientist

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Conditions of a Perfect Storm

- By 2030 "a whole series of events come together":
- The world's population will rise from 6bn to 8bn (33%)
- Demand for food will increase by 50%
- Demand for water will increase by 30%
- Demand for energy will increase by 50%

Source -Sir John Beddington –Chief Scientist – UK 2015

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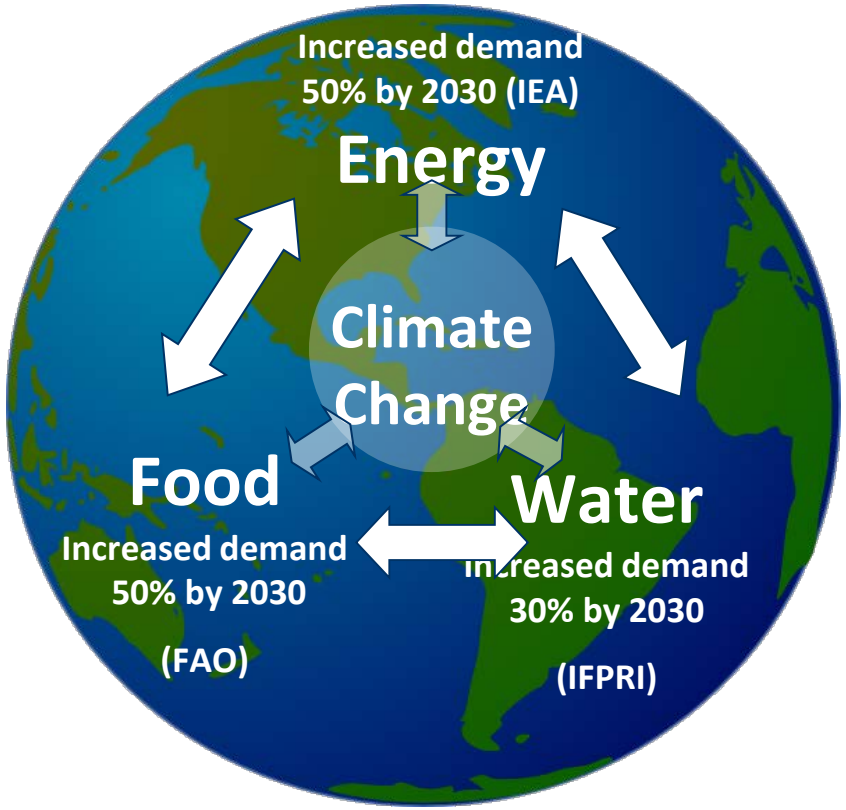
The Perfect Storm?



1.Can 9 billion people be fed equitably, healthily and sustainably?

2.Can we cope with the future demands on water?

3.Can we provide enough energy to supply the growing population coming out of poverty?

4.Can we mitigate and adapt to climate change?

5.Can we do all this in the context of redressing the decline in biodiversity and preserving ecosystems?

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Canonical Representation of SDGs

People, Prosperity, Peace, Partnership, Planet

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Role of Education in delivering SDGs

GOAL 1: End poverty in all its forms everywhere

- Education:
  - offers better livelihoods
  - enables earning of higher wages
  - critical to escape chronic poverty.
  - prevents the transmission of poverty between generations.

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Role of Education in delivering SDGs

GOAL 2 End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.

- Education:
  - leads parents to apply appropriate health and hygiene practices
  - helps ensure a varied diet
  - helps reduce obesity

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Role of Education in delivering SDGs

GOAL 3: Ensure healthy lives and promote well-being for all.

- Mothers' education has saved millions of children's lives
- Education plays a major role in containing disease

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Role of Education in delivering SDGs

GOAL 4 Ensure inclusive and equitable quality education and promote life-long learning opportunities for all.

- Education: Learning in infancy yields achievement and attainment in primary school and beyond.

  With more years of schooling, the next generation is even more educated.

  Good quality education offers efficiency gains for societies and governments

  Equity and inclusion in education enables best possible learning outcomes

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Role of Education in delivering SDGs

GOAL 5: Achieve gender equality and empower all women.

- Education
  - Passport for women to enter the labour force.
  - Helps women have a voice.
  - Helps avert child marriage
  - Builds women's confidence and perception of their freedom.
  - Influences women's choice of family size

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Role of Engineering in Delivering SDGs

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Role of Engineering in delivering SDGs

GOAL 1: End poverty in all its forms everywhere

- Technology offers opportunities for the poorest and most vulnerable
- Provision of basic services
- Applied technology and provision of urban systems that make growth (wealth creation) possible

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Role of **Engineering** in delivering SDGs

GOAL 2

End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.

- Applying innovations and new technologies and Sustainable intensification could end chronic hunger.
- Manage the nitrogen cycle
- Sustainable irrigation
- Sustainable transportation
- Adjudicate genetically modified organisms

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Role of Engineering in delivering SDGs

GOAL 3: Ensure healthy lives and promote well-being for all.

- Improving access to healthcare services through technology
- Engineering solutions are key to empowering local health workers to provide accessible, quality healthcare.
- Engineer better medicines
- Advance health informatics
- Clean air, clean water, safe food production
- Develop bioengineering and nanotechnology life
- improvement in devices and materials

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Role of Engineering in delivering SDGs

GOAL 4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

- Improving lives through the advancement of learning
- Promoting Engineering skills to develop the infrastructure to improve lives.
- Improving engineering education and making sure future engineers are of the best calibre to have a global impact.
- Quality engineering education in all countries will ensure effective local workforce

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Role of Engineering in delivering SDGs

GOAL 5: Achieve gender equality and empower all women.

- Empowering women to reach society's full potential
- Increase participation of women in all engineering fields
- Raising women's workforce participation to the same level as men's could raise GDP per capita by significant amounts – in Egypt for example, by 34%

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Role of Engineering in delivering SDGs

GOAL 6: Ensure availability and sustainable management of water and sanitation for all

- Provide clean water for all
- Reaching everyone, everywhere with water, sanitation and hygiene by 2030 requires a major shift in political will and prioritisation, investment in human resources, regulation and systems.

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Role of Engineering in delivering SDGs

GOAL 7: Ensure access to affordable, reliable, sustainable and modern energy for all

- Universal Energy Access: Going further, faster, and at lower cost
- Increase efficient use of energy
- Make Solar Energy Economical
- Ensure safe nuclear power
- Provide energy from renewable
- Energy enterprises to find new ways to serve low-income consumers

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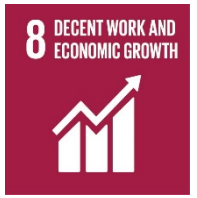
Role of Engineering in delivering SDGs

GOAL 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all



- Apply finest engineering minds and develop of new technologies.
- Restore and improve urban infrastructure
- Provide the underpinning of wealth generation, e.g. urban systems, mobility, communication, data
- Safe and inclusive work environment for professionals

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Role of Engineering in delivering SDGs

GOAL 9: Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation

- Sustainable and resilient infrastructure
- Sustainable manufacturing
- Data infrastructure is an asset that needs to be invested in.
- An effective, efficient and equitable data infrastructure will generate value for this and succeeding generations.

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Role of Engineering in delivering SDGs

GOAL 10: Reduce inequality within and among countries

- Engineers and entrepreneurs hold the key to reducing inequality
- To build inclusive, productive economies on a platform of sustainable energy and infrastructure
- Provide global example within profession. Highlight the negative consequences of inequality on engineering systems,'

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Role of Engineering in delivering SDGs

GOAL 11: Make cities and human settlements inclusive, safe, resilient and sustainable

- What engineers do in cities will set the course for the next century – for better or worse.
- Restore and improve urban infrastructure
- Develop technologies and processes globally to ensure safety and security across engineered systems cybersecurity for mass transit.

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Role of Engineering in delivering SDGs

GOAL 12: Ensure sustainable consumption and production patterns

- Contribute to the Circular economy
- By implementing new engineering measures to drive eco-efficiency across industry networks, provides cumulative benefits and business driven innovation.
- Enhanced resource efficiencies, industrial ecology and demineralization
- Minimize waste in the manufacture of products

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Role of Engineering in delivering SDGs

GOAL 13: Take urgent action to combat climate change and its impacts

- Resilience represents the $200 billion engineering challenge
- Protecting assets from the effects of climate change is one of the great demands made of engineers over the coming years.
- Develop carbon sequestration methods; reduce greenhouse emissions from the built environment
- Monitor, research and provide professional input on role of geoengineering
- Sustainable Energy for All; safe nuclear power
- Make the built environment adaptable and resilient to uncertain climate and weather extremes

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GOAL 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development

- Combining engineering solutions and policy change to cut down plastic pollution.
- Partnerships between stakeholders, governments, the private sector, academic institutions and citizens are needed to work together to free the world from long lasting pollutants.
- Better provision of independent data

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Role of Engineering in delivering SDGs

GOAL 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss.

- A holistic approach to regenerative development is the only way to halt biodiversity loss
- Restore organic matter to degraded soils
- Better integrate biofuels

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Role of Engineering in delivering SDGs

GOAL 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

- Engineering peaceful and inclusive societies
- For developing countries to promote innovation by adding engineering courses
- Building engineering capabilities offers the best opportunity for technological leapfrogging and catch-up
- Prevent nuclear terror
- Secure Cyberspace

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Role of Engineering in delivering SDGs

GOAL 17: Strengthen the means of implementation and revitalise the global partnership for sustainable development

- Harnessing the Power of Technology for a Sustainable Future

- Engineers can design sustainable solutions on food, healthcare, water, energy, transportation, waste disposal, telecommunications and infrastructure.

- Engineers are essential partners in moving from design to delivery. Play a more active role as practitioners of sustainable development

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Contributions of Engineering Report II

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Contributions of Engineering Report II

UNESCO's Engineering Report II will contribute to direction of travel for the achievement of the 2030 Agenda , by:

- Providing information and recommendations on tertiary and higher education, to improve education for everyone under SDG 4, target 4b.
- Addressing the gender imbalance issue in engineering and provide recommendations related to women in engineering - addressing SDG 5, target 5.5.
- Including a component on employment in the engineering industry thus addressing SDGs 8 and 9.
- Preparing in collaboration with other international organisations and institutions of benefit to least developed countries supporting SDG 17.

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Contributions of Engineering Report II

4.b By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, Small Island Developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries.

5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women

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References to Technology in SDG Targets

1.4,

2a,

4b,

5b,

7a, 7b,

9b, 9c,

14a,

17.6,17.7, 17.8.

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- Key References:

ROYAL ACADEMY OF ENGINEERING

Achieving the United Nations Sustainable Development Goals

World Federation of Engineering Organizations
Fédération Mondiale des Organisations d'Ingénieurs

22 July 2015 Version 1.6

WFEO ENGINEERS FOR A SUSTAINABLE POST 2015

World Federation of Engineering Organizations (WFEO) -UN Relations Committee (WURC)

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Aspects of Engineering Education

Preparing engineers to face SDG challenges

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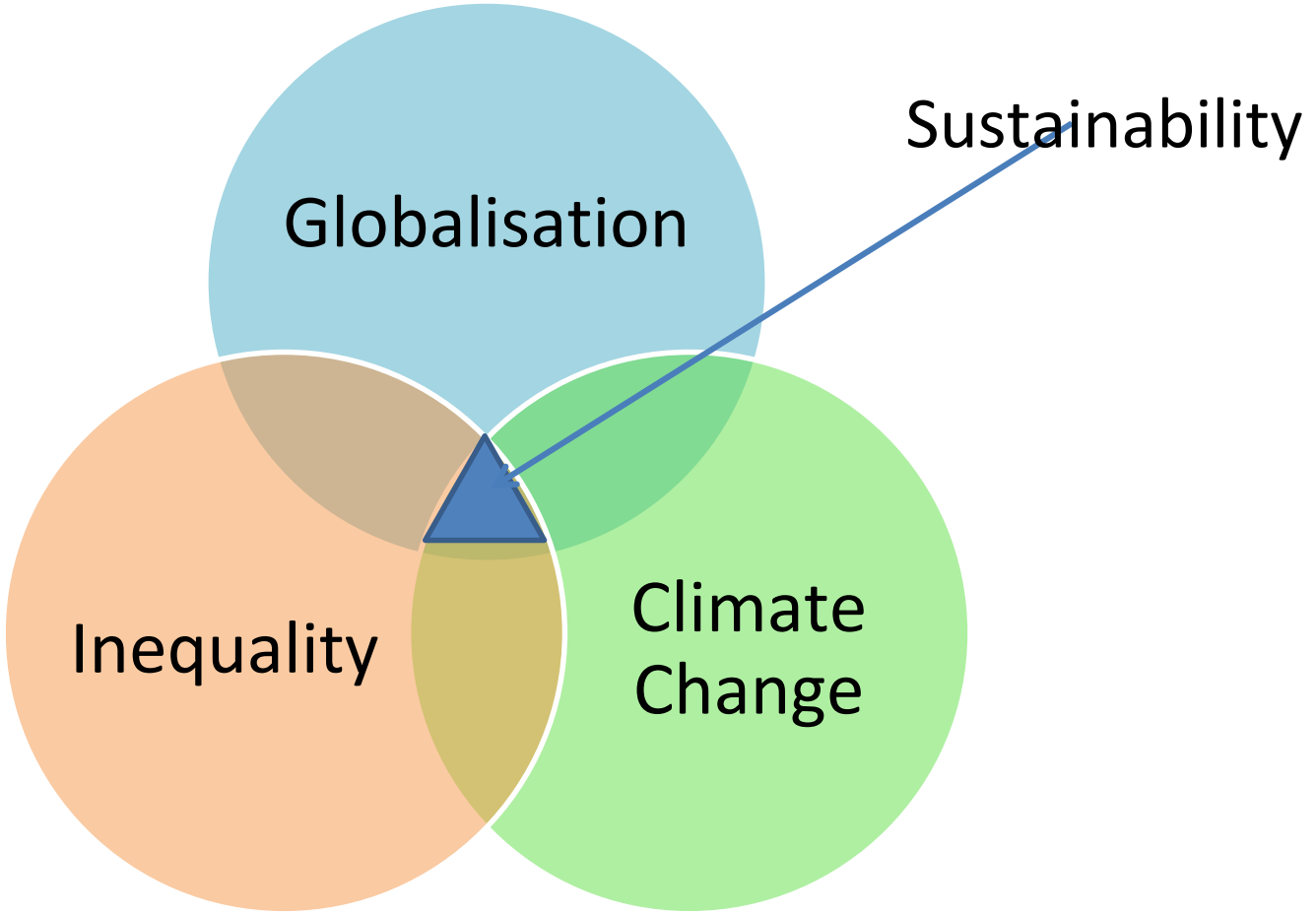
Global trends till 2030

(UK Royal Academy of Engineering Report)



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Sustainability Engineering

- Based on systems theory aimed at solving complex and daunting problems, which affect humanity; have associated underlying technical and social aspects.

- With their strong technical background and potential to understand complex systems, **engineers** can and must play a role in addressing these global challenges.

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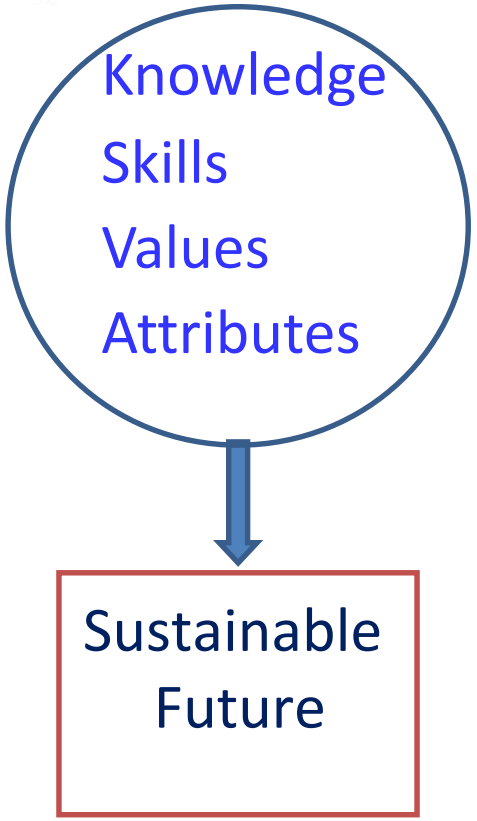
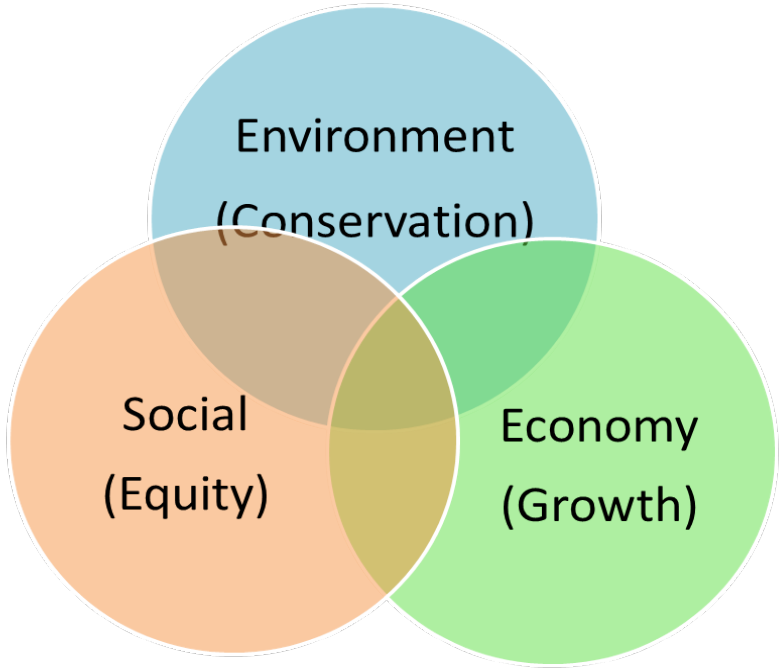
Role of Education

- Concepts of sustainability





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Sustainable Engineering Education

- Integrated approach to knowledge, attitudes, skills and values in teaching.
- Incorporate disciplines of the social sciences and humanities.
- Promote multidisciplinary teamwork.
- Stimulate creativity and critical thinking.
- Foster reflection and self-learning.
- Raise awareness for the challenges posed by globalisation.

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Sustainability paradigm shift

- In Engineering Education - Transition from a focus on technical issues to problems and topics that require an integrated, adaptive and participatory approach.

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Academic Challenges

- Hard Science and Engineering vs Soft/social Sciences
- Tension in accommodating Sustainability related elements in Curriculum
- Faculty knowledge of issues, social awareness e.g. understanding of Economic, Environmental issues and impact, lack of knowledge of social/societal factors

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Sustainability-focused courses:

- Sustainability
- Global warming and climate change
- Green technology and design
- Renewable energy generation
- Resource conservation,
- Environmental history

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Sustainability-focused courses related topics:

- Environmental law and policy
- Economics and the environment
- Geology
- Risk management

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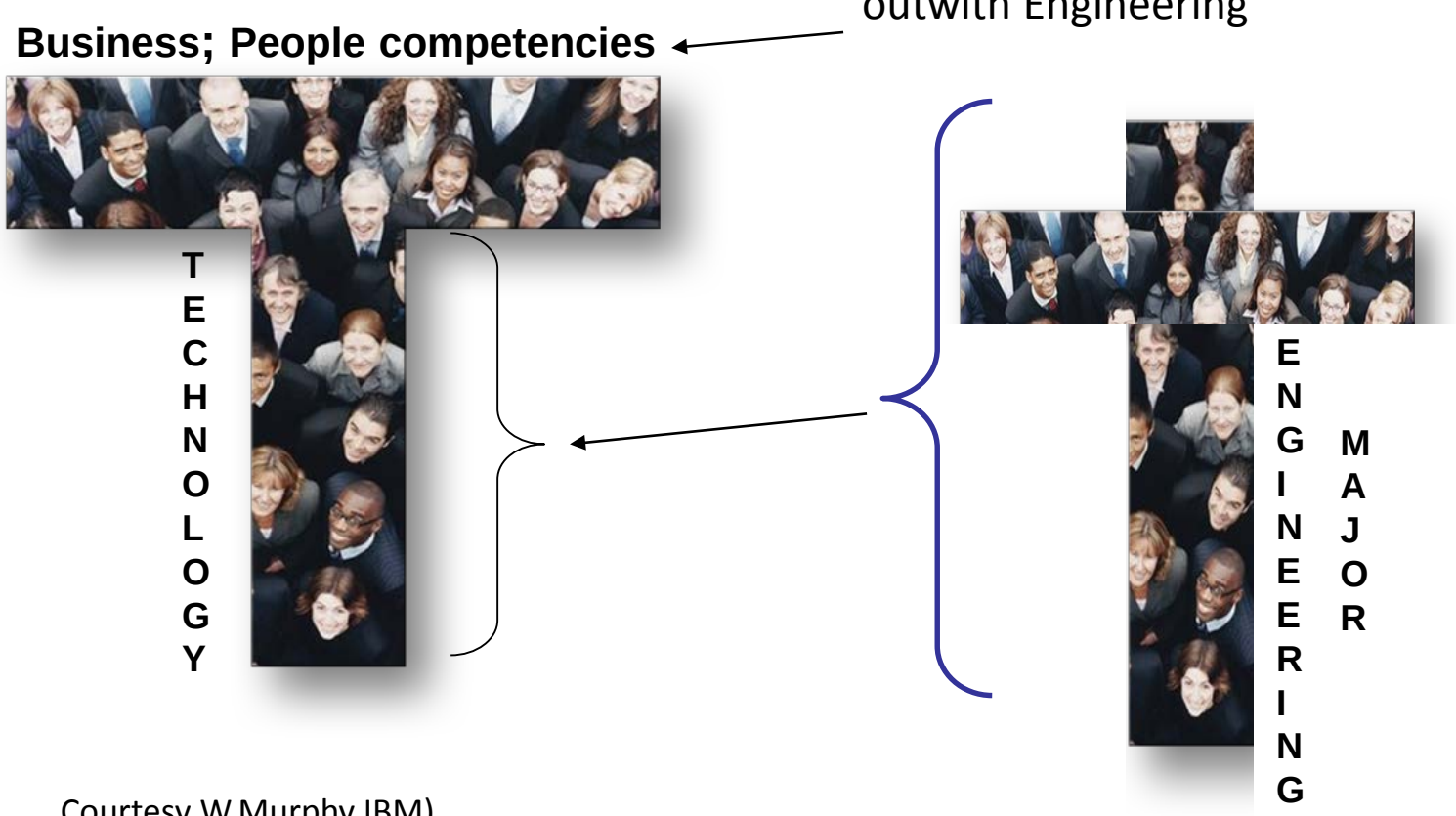
T-shaped Engineer

Understanding & valuing competencies outwith Engineering



Courtesy W.Murphy IBM)

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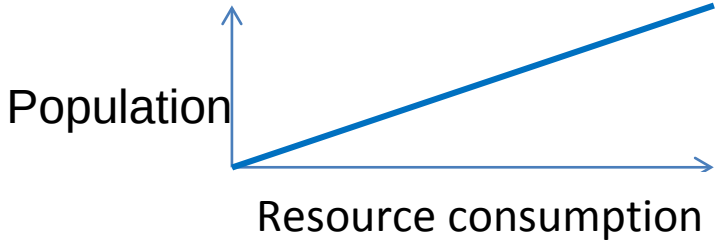
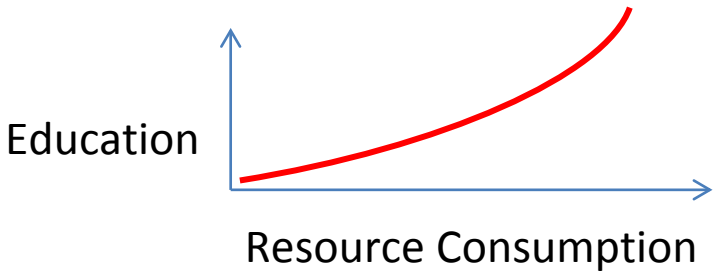
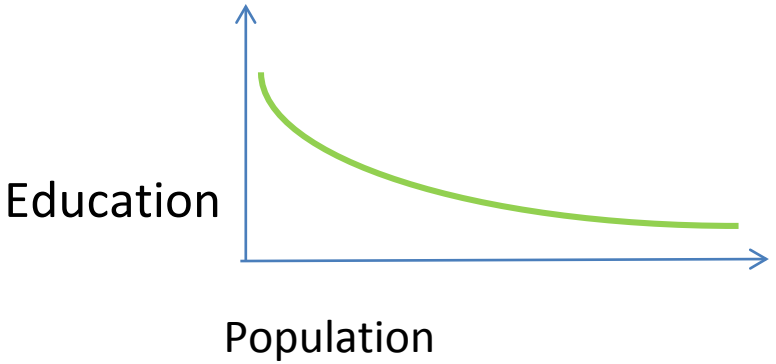
国际工程教育中心 由教科文组织支持

Education: Promise and Paradox







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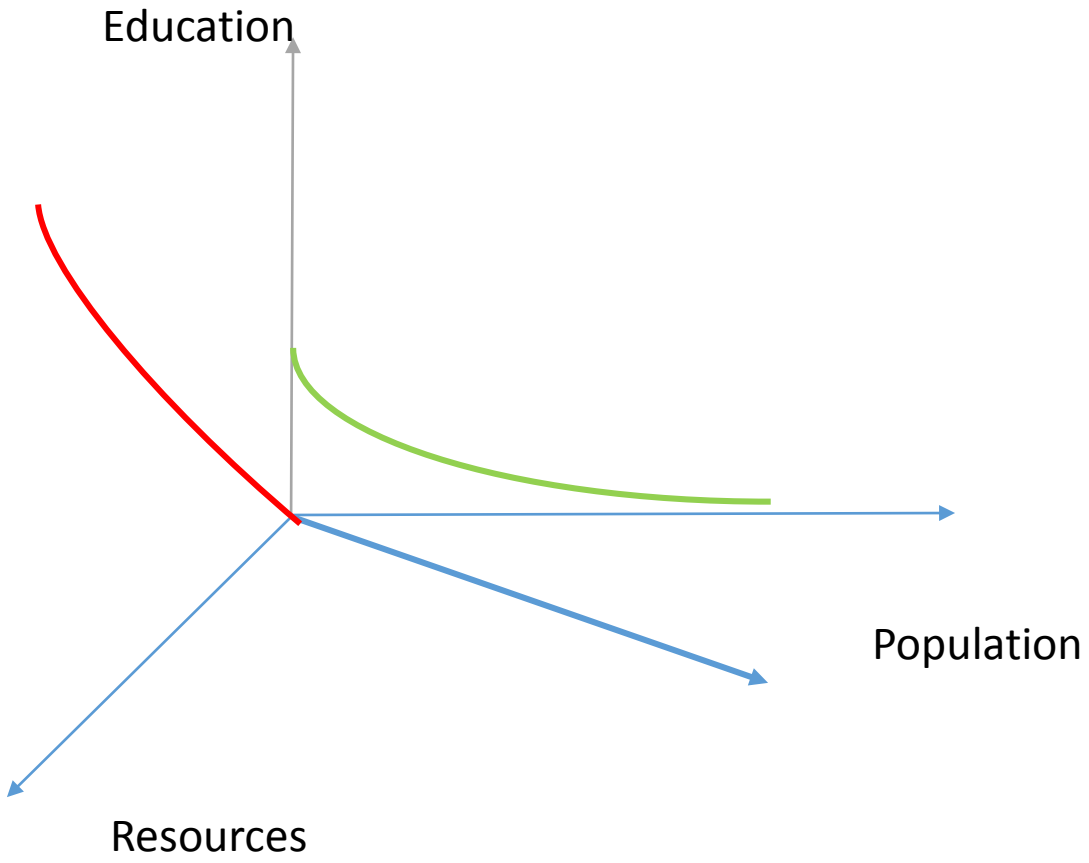

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- Discussion
- Q & A.